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The effect of "laboratory practices in science teaching" course on development of prospective science teachers' self- regulation skills

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Abstract

In this study, prospective elementary school science teachers' self-regulation skills intended for motivational beliefs, cognitive and meta-cognitive strategies and resource managing strategies are examined within "Laboratory Practices in Science Teaching" course. The purpose of the study is to determine that if "Laboratory Practices in Science Teaching" course is effective on the development of prospective elementary science teachers' self-regulation skills development. Correspondingly to the importance of "Laboratory Practices in Science Teaching" course's effect on development of self-regulation skills during elementary Science teaching, the requirement of elementary Science teachers' enough proficiency on using self-regulation strategies makes the study important.

Keywords: self-regulation skills; meta-cognitive strategies; resource managing strategies; motivational beliefs; prospective science teachers; Laboratory practices.

1. Introduction

Meta-cognition is thinking about what we know and what we do not know. Similar to a manager's job that is management of an organization, the job of a philosopher is thinking about thinking way (Blakey & Spence, 1990). So metacognition includes knowledge and regulation of one's thinking processes. Metacognition is the process by which individuals think about their own thinking in order to develop strategies to solve problems (O'Neil & Brown, 1997). Metacognition is defined as a transitory state in intellectual situations that varies in intensity, changes over time (O'Neil & Brown, 1997).

Meta-cognitive beliefs, meta-cognitive awareness, meta-cognitive experiences, meta-cognitive knowledge, seeking knowledge, deciding to learning, meta-memory, meta-cognitive skills, management skills, high-level skills, meta-cognitive components, self-regulation, learning strategies are some terms in relation to meta-cognition (Veenman, Hout & Afflerbach, 2006). While some of these terms are related to meta-cognitive skills, some are related to both cognitive and meta-cognitive processes. In some researches about relationship between genders and meta-cognition, it is found that there is a significant relation between the two variables and this relationship is positive for girls (Topcu & Yilmaz-Tuzun, 2009; Wolters & Pintrich, 1998; Mok, Fan & Pang, 2007; Peklaj &

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Pecjack; 2002). Stewart, Cooper and Moulding (2007) found that there is no significant gender difference between undergraduate and graduate teacher-students. Metacognitive development can therefore be described as a development in one's metacognitive abilities, i.e. the move to greater knowledge, awareness and control of one's learning (Çubukçu, 2008).

For the effective science teaching, it needs that the teachers' knowledge, skills and attitudes to science and application laboratories should be at desirable level. In this context, the expected basic laboratory skills from prospective teachers in laboratory application process are important in terms of basic skills helping for developing positive attitudes, which they would use in their lives and learning environments as well as in learning process (Hegarty – Hazel, 1990). However, laboratory applications help for developing students' existing concepts, cognitive skills and meta-cognitive competences.

In this study, prospective elementary school science teachers' self-regulation skills intended for motivational beliefs, cognitive and meta-cognitive strategies and resource managing strategies are examined within "Laboratory Practices in Science Teaching" course. The purpose of the study is to determine whether "Laboratory Practices in Science Teaching" course is effective on the development of prospective elementary science teachers' development of self-regulation skills. Correspondingly to the importance of the influence of "Laboratory Practices in Science Teaching" course on development of self-regulation skills during elementary Science teaching, the requirement of elementary Science teachers' proficiency on using self-regulation strategies makes the study important. By following this purpose, the sub-problems are determined:

1. Is there any significant difference among the motivational, cognitive and meta-cognitive competences of the prospective elementary school science teachers, who took "Science and Technology Laboratory" course?
2. Is there any significant difference among the motivational, cognitive and meta-cognitive competences of the prospective elementary school science teachers before taking "Science and Technology Laboratory" course, in terms of gender?
3. Is there any significant difference among the motivational, cognitive and meta-cognitive competences of the prospective elementary school science teachers after taking "Science and Technology Laboratory" course, in terms of gender?

2. Method

In the study, single group pre-test–treatment-post-test experimental model was used. The scale used in the study, called as "Motivated Strategies for Learning Questionnaire" was developed by Pintrich, Smith, Garcia and Mc Keachie (1991) and translated to Turkish by Altun and Erdem (2006). The validity and reliability of the original scale was evaluated by the researchers for this study. For analyzing the reliability of the scale, 115 prospective science and elementary school teachers were chosen randomly. Consequently, Cronbach Alpha reliability co-efficient was found 0.96. The practicing of MSLQ scale is directed to measure the students' using rates of self-regulation and learning strategies in relation to a specific course and their motivational beliefs. The scale of "Motivational Strategies for Learning" is seven point likert scales comprising of 81 questions in total. The scale comprises three dimensions as "Motivational Beliefs", "Cognitive and Meta-Cognitive Self-Regulation" and "Resource Management Strategies". In this study, the scale was turned over generally, not examined from the point of lower dimensions. "The theory underlying the scale admits that self-regulation skills show changeable context-oriented charecter according to classes and subjects (Pintrich and others, 1993). Therefore, aforementioned researchers suggest that the results of the performed studies should be evaluated in a course context" (Altun & Erden, 2006).

In the study, "Motivated Strategies for Learning Questionnaire (MSLQ)" was applied on the sample (n = 140) within "Laboratory Practices in Science Teaching (LPST)" course at the beginning and end of 2008-2009. Data were analysed by using t-test and Anova in SPSS 11.5 statistical package program.

3. Results (Findings)

In this research, the findings obtained for the sub-problems and the discussion are given below.

Considering the first sub-problem of the study; "if there is any significant difference among the motivational, cognitive and meta-cognitive competences of the prospective elementary school science teachers, who took

"Science and Technology Laboratory" course", the differentiation of the prospective elementary school science teachers' self-regulation skills intended for motivational beliefs, cognitive and meta-cognitive strategies and resource managing strategies were examined, and the findings at Table 1 were obtained.

Table 1. Differentiation of the elementary school science teachers' Self- regulation according to LPST

LPS Γ	N	Means	Standard] eviation	t	p
Before tak ıg LPST cou e	87	381.2	36. 7	8.32	.000*
After taki g LPST cou e	87	423.03	29. 0		

* significant at p<.05 level

When Table 1 is examined, it can be seen that the prospective elementary school science teachers' self-regulation skills are lower before taking LPST course while the skills are higher after taking this course. Also, according to the t-test results, which was applied for understanding if the strategy using difference is much for males or females, it is concluded that the self-regulation skills of the elementary school science teachers for both genders increased after they took LPST course (Female; t= 7.97; p<.000. Male; t=3.65; p<.000).

Also, according to the result of t-test applied for understanding if this difference is for the benefit of female students or male elementary school science teachers, both genders' self-regulation skills was increased this difference arising before and after taking LPST course

The second sub-problem of the study was about to see "if there is any significant difference among the motivational, cognitive and meta-cognitive competences of the prospective elementary school science teachers, before taking "Science and Technology Laboratory" course, in terms of gender." The differentiation of the prospective elementary school science teachers' self-regulation skills intended for self-regulation skills according to their genders were examined, and the findings at Table 2 were obtained.

Table 2. Differentiation of the elementary school science teachers' Self-Regulation Skills according to their Genders

Gender	N	Means	Standard] eviation	t	p
Male	43	379.089	32.0 5	.558	.579
Female	44	383.575	41.9 7		

When Table 2 is examined, it is seen that there is no significant difference among using of self-regulation strategies in terms of gender before taking LPST course.

Regarding to the third sub-problem, the differentiation of the prospective elementary school science teachers' self-regulation skills intended for self-regulation skills according to their genders were examined, and the findings at Table 3 were obtained.

Table 3. Differentiation of the elementary school science teachers' Self-Regulation Skills according to their Genders

Gender	N	Means	Standard] eviation	t	p
Male	43	424.429	26.8 4	.699	.486
Female	44	419.654	34.5 3		

When Table 3 is examined, it is seen that there is no significant difference between the self-regulation skills of both female and male elementary school science teachers after taking LPST course.

4. Discussion, Conclusion and Recommendation

Metacognition and its components show learning advantages for students who monitor their progress, metacognition alone cannot explain why students choose to regulate their learning. In fact, students must want to learn (Kauffman, 2004). As a result of the research, it is seen that the Laboratory Practices in Science Teaching Course has effects on self-regulation skills of the prospective science teachers. The higher the self-regulation skills of the teachers guiding the students and helping them to recognize the scientific knowledge, the higher training and instruction which they gave to their students. Therefore, it is important to determine the self-regulation skills of the

science teacher candidates, and to instruct according to that. In this respect, it is an expected result for the Laboratory Practices in Science Teaching Course to increase and improve the self-regulation skills strategies of the prospective science teachers.

At the end of this study, it is concluded that LPST course increased the prospective science teachers' self-regulation skills. When the prospective elementary school science teachers were observed before and after taking LPST course, it is seen that there is no significant difference between self-regulation skills and gender. It is observed that the same elementary school science teachers' self-regulation skills showed augmentation after taking this course regardless of two genders. When the effect of LPST course on the elementary school science teachers was examined regarding gender, it can be said that the course's effect did not change to gender, but it increased both female and male elementary school science teachers' self-regulation skills (Stewart, Cooper & Moulding, 2007).

One of the limitation of the study is to use the scale without considering its' lower dimensions. Therefore, it can be concluded that since there was no significant relationship among academic achievement and the using of self-organizing strategies in general, there might be no difference or no significant relationship among the variables in relation to the lower dimensions.

At the end of the study, some implications may be developed:

- The laboratory environments, where students can learn by doing and living, are very important places for the students' development of self-regulation skills. Therefore, especially during the prospective science teachers' educations, the laboratory applications should be allowed for more.
- This study should be repeated on more samples for investigating if there could be seen different results.
- The development of self-regulation strategies should be investigated for not just the prospective elementary school science teachers' academic achievements before and after taking "Science and Technology Laboratory" course during the whole undergraduate school period, four years, with a longitudinal study.
- We believe that the relationship between the prospective science teachers' development of self-regulation skills should not be just examined with regard to gender variable, but also it needs to be examined from the point of socio-economic variables and academic achievement.
- In the future study, the lower dimensions not discussed in this study should be investigated in order to understanding the self-organizing and motivational strategies and their relationships with academic achievement.

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